

CLAIMS

1. An optical waveguide circuit, comprising:

a first core;

5 a cladding that buries said first core; and

a second core that is formed between said first core and cladding and covers at least a part of said first core,

wherein the refractive index of said second core is higher than the refractive index of said cladding, and the boundary

10 between said second core and cladding is made smooth..

2. An optical waveguide circuit that allows an optical

signal propagating through at least one optical waveguide to branch into a plurality of optical waveguides, or converges

optical signals propagating through a plurality of waveguides

15 into at least one optical waveguide,

said plurality of optical waveguides comprising:

a plurality of first cores which each interval becomes wider as said first cores get away from a branch point or converging point of an optical signal;

20 a cladding that buries at least said first cores;

a second core that is so formed between said first cores and cladding as to cover up at least a part of each of said first cores and is formed in the gaps between said first cores at the position in the vicinity of the branch point or

25 converging point,

wherein the refractive index of said second core is higher than the refractive index of said cladding,

the boundary between said second core and cladding is made smooth, and

the film thickness of said second core formed in the gaps between said first cores becomes thinner as the interval between said first cores becomes wider.

3. The optical waveguide circuit according to claim 2,

5 wherein said optical waveguide circuit is a Y-shaped branch circuit.

4. An optical waveguide circuit comprising:

a first slab waveguide connected at least one input waveguide;

10 a second slab waveguide connected at least one output waveguide; and

arrayed waveguides formed between said first and second waveguides with optical path length differences,

said arrayed waveguides comprising:

15 a plurality of first cores;

a cladding that buries said first cores;

a second core that is so formed between said first cores and cladding as to cover up at least a part of each of said first cores and is formed in the gaps between said first cores
20 at least at connection areas between said first and second slab waveguides and said arrayed waveguides and areas near the connection areas,

wherein the refractive index of said second core is higher than the refractive index of said cladding,

25 the boundary between said second core and cladding is made smooth, and

the film thickness of said second core formed in the gaps between said first cores of said arrayed waveguides becomes thinner as the interval between said first cores becomes wider.

5. An optical waveguide circuit comprising proximity waveguides in which a plurality of first cores are nearby arranged to each other,

said proximity waveguides comprising:

5 a plurality of first cores;

a cladding that buries said first cores; and

a second core that is formed between said first cores and cladding to cover up at least a part of each of said first cores and is formed in the gaps between said first cores,

10 wherein the refractive index of said second core is higher than the refractive index of said cladding, and the boundary between said second core and cladding is made smooth.

6. The optical waveguide circuit according to claim 1, wherein said first core that is covered by said second core
15 has a substantially rectangular cross-section, and said second core covers the upper surface and both side surfaces of said first core.

7. The optical waveguide circuit according to claim 2, wherein said first core that is covered by said second core
20 has a substantially rectangular cross-section, and said second core covers the upper surface and both side surfaces of said first core.

8. The optical waveguide circuit according to claim 4, wherein said first core that is covered by said second core
25 has a substantially rectangular cross-section, and said second core covers the upper surface and both side surfaces of said first core.

9. The optical waveguide circuit according to claim 5, wherein said first core that is covered by said second core

has a substantially rectangular cross-section, and said second core covers the upper surface and both side surfaces of said first core.

10. The optical waveguide circuit according to claim 1,
5 wherein the thickness of said second core that covers at least a part of said first core is less than or equal to twice the thickness of said first core.

11. The optical waveguide circuit according to claim 2,
wherein the thickness of said second core that covers at least
10 a part of said first core is less than or equal to twice the thickness of said first core.

12. The optical waveguide circuit according to claim 4,
wherein the thickness of said second core that covers at least
a part of said first core is less than or equal to twice the
15 thickness of said first core.

13. The optical waveguide circuit according to claim 5,
wherein the thickness of said second core that covers at least
a part of said first core is less than or equal to twice the
thickness of said first core.

20 14. The optical waveguide circuit according to claim 1,
wherein the refractive index of said second core is less than
or equal to 1.01 times the refractive index of said first core.

15. The optical waveguide circuit according to claim 2,
wherein the refractive index of said second core is less than
25 or equal to 1.01 times the refractive index of said first core.

16. The optical waveguide circuit according to claim 4,
wherein the refractive index of said second core is less than
or equal to 1.01 times the refractive index of said first core.

17. The optical waveguide circuit according to claim 5,

wherein the refractive index of said second core is less than or equal to 1.01 times the refractive index of said first core.

18. A manufacturing method of an optical waveguide circuit including a core and a cladding that buries said core, said

5 method comprising at least the steps of:

forming a core layer;

selectively etching said core layer to form a first core;

forming a second core layer that covers the upper surface and both side surfaces of said first core, said second core

10 layer being made of a material having a refractive index higher than the refractive index of said cladding;

applying a heat reflow to said second core layer to smooth the surface thereof to complete a second core; and

forming said cladding on said second core.

15 19. A manufacturing method of an optical waveguide circuit that allows an optical signal propagating through at least one optical waveguide to branch into a plurality of optical waveguides, or converges optical signals propagating through a plurality of waveguides into at least one optical waveguide,

20 the method comprising at least the steps of:

forming a core layer;

selectively etching said core layer to form a plurality of first cores which each interval becomes wider as said first cores get away from a branch point or converging point of an

25 optical signal;

forming a second core layer on the upper portion of each of said first cores and between said first cores at least at the area including the portion near the branch point or converging point of said first cores, the second core layer

being made of a material having a refractive index higher than the refractive index of said cladding;

applying a heat reflow to said second core layer to smooth the surface thereof and forming a second core such that
5 the film thickness of said second core layer that is formed in the gaps between said first cores becomes thinner as the interval between said first cores becomes wider; and

forming said cladding on said second core.

20. A manufacturing method of an optical waveguide circuit
10 comprising:

a first slab waveguide connected at least one input waveguide;

a second slab waveguide connected at least one output waveguide; and arrayed waveguides including a plurality of
15 cores and formed between said first and second slab waveguides with optical path length differences, said method comprising at least the steps of:

forming a core layer;

selectively etching said core layer to form the plurality
20 of first cores which each interval becomes wider as said first cores get away from a connection point between said first and second slab waveguides and said arrayed waveguides;

forming a second core layer on the upper portion of each of said first cores and between said first cores at least at
25 the area including connection areas between said first and second slab waveguides and said first cores and portion near said connection areas, the second core layer being made of a material having a refractive index higher than the refractive index of said cladding;

applying a heat reflow to said second core layer to
smooth the surface thereof and forming a second core such that
the film thickness of said second core that is formed in the
gaps between said first cores becomes thinner as the interval
5 between said first cores becomes wider; and

forming said cladding on said second core.

21. A manufacturing method of an optical waveguide circuit
comprising proximity waveguides in which a plurality of first
cores are nearby arranged to each other, said method
10 comprising at least the steps of:

forming a core layer:

selectively etching said core layer to form said
plurality of first cores;

forming a second core layer on the upper portion of each
15 of said first cores and between said first cores at least at
the area including said proximity waveguides and the portion
near said proximity waveguides, said second core layer being
made of a material having a refractive index higher than the
refractive index of said cladding;

20 applying a heat reflow to said second core layer to
smooth the surface thereof to obtain a second core; and
forming said cladding on said second core.